

been produced on these and on *F. mexicana* by artificial inoculation. The injury is seldom severe.

ANGULAR LEAF SPOT

A species of *Septoria* was found to produce small, angular, brown leaf spots (pl. 3, fig. C) which may coalesce to form rather large necrotic areas. Premature defoliation may result where overhead sprinkling is practiced. The small, black pycnidia of the fungus are produced in dense groups beneath the epidermis of the ventral surfaces of the leaves and eventually the ostioles break through to the surface. Conidia from the leaf are one- to three-septate, mostly one-septate, whereas from culture they are one- to many-septate. This fungus does not seem to have been previously described and we therefore submit it as a new species.

Septoria angularis sp. nov. Maculis irregularibus angulatis, fuscis; pycnidiis epiphyllis, subepidermicis, dense gregariis, globosis, 50–70 μ diam., ostiolo minuto perforatis; sporulis oblongis utrinque attenuatis, 1–3-septatis, non constrictis, hyalinis, 10–17 \times 1.5–2 μ ; sporophoris papilli formibus. Hab. in foliis *Fremontiae* (Sterculiaceae) Amer. Bor.

Type. On leaves of *Fremontia mexicana* (Davidson) Macbride; nursery in Morgan Hill, Santa Clara County, California, May, 1935, *Harvey E. Thomas* (Herbarium of the University of California no. 688926).

This leaf spot was found also on *Fremontia* growing in a garden of native plants at Santa Barbara. It has been produced by artificial inoculation on the three species of *Fremontia* mentioned above.

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NOTES ON THE GENUS ELYMUS

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Relationships in the *Elymus triticoides*—*E. condensatus*—*E. cinereus* complex of western North America never have been satisfactorily explained, especially in respect to the plants of coastal California. Hitchcock (1) more or less arbitrarily distinguished two species but recognized the possibility of a third entity in the "giant rye grass" of southern California. His discussion of *E. condensatus* is concluded with the statement, "On the coast of California there is a form with robust culms as much as 3 m. tall, compound spikes as much as 30 cm. long and 4 cm. thick, the ascending compound branches sometimes 6 cm. long. This form usually has pronounced rhizomes; possibly distinct." The type of *E. condensatus* from "Monte-Rey, California" has not been examined

(it was at Prague at the outbreak of the war) but from the type description and a photograph of the type sheet it may be judged to be the "form" characterized by Hitchcock. There is sufficient evidence to indicate that plants of the Great Basin area which have been referred to *E. condensatus* constitute a distinct species, the correct name for which is *E. cinereus* Scribn. & Merr.

Recent investigation utilizing data from studies of polyploidy in this group have clarified our understanding of species relationships and also have contributed to our knowledge of subspecific differentiation. Tetraploids ($2n = 28$) are known in all three species; hexaploids are found in *E. triticoides*, and octoploids in *E. condensatus* and *E. cinereus*. Diploids have not been found in these nor any other North American species of *Elymus*. Differences in chromosome number are for the most part accompanied by morphological differences but notable exceptions exist in *E. triticoides* hexaploids, some of which closely resemble the tetraploids. In respect to distribution, *E. condensatus* and *E. cinereus* have separate ranges and different habitat preferences from each other (fig. 1) but the extremely polymorphic *E. triticoides* is widely distributed throughout the ranges of the other two, often growing intermingled with them.

In the following amplified descriptions, notes, and key our understanding of relationships in this group is presented.

- Culms 6-10 mm. in diameter at base; leaves 15-35 mm. broad; spikelets 8 to 40 at a node (including those on branchlets) 1. *E. condensatus*
- Culms 6 mm. or less in diameter; leaves 3-15 mm. broad; spikelets 1 to 6 at a node, rarely more.
Culm nodes (or vicinity of nodes) with fine, usually dense pubescence; plants non-rhizomatous 2. *E. cinereus*
- Culm nodes glabrous; plants rhizomatous.
Culms 2-3.5 mm. in diameter; leaf blade 3 to 6 mm. broad; spikes with 1 to 2 occasionally 3 spikelets at a node; spikelets 8-15 mm. long with 3 to 6 florets 3. *E. triticoides*
- Culms 3.5-5 mm. in diameter; leaf blade 6-15 mm. broad; at least some nodes of spike with 3 to 6 spikelets, or spikelets 17-25 mm. long with 6 to 9 florets 4. *E. triticoides* subsp. *multiflorus*

1. ELYMUS CONDENSATUS Presl, Rel. Haenk. 1: 265. 1830.

Perennial; culms stout 1.5-3.5 m. tall, usually in dense clumps; rhizomes short, thick, generally produced along the margins of clumps; leaf blades often more than 2 cm. broad, glabrous or with fine silvery pubescence, exceptionally tough and fibrous; spikes 15-40 cm. long, with numerous, often compound, erect branchlets bearing one to many spikelets; spikelets relatively small, 10-15 mm. long, 3- to 6-flowered; florets frequently sterile, often not maturing; glumes subulate or flat and narrow, equal to or slightly

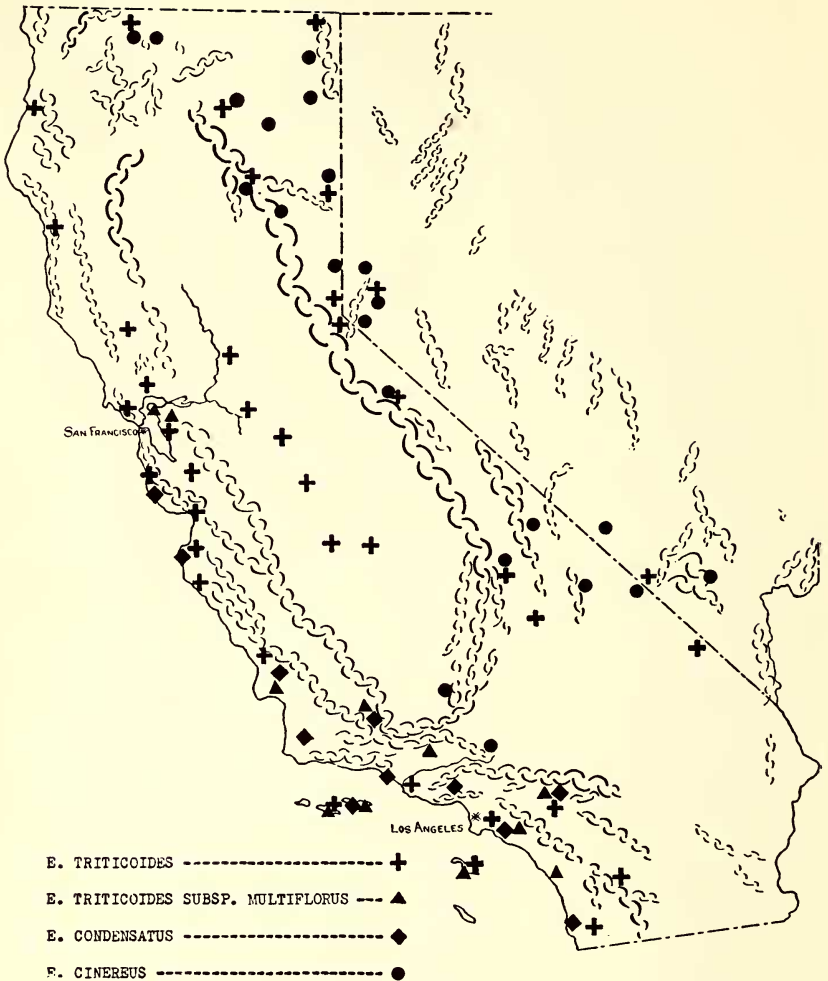


FIG. 1. Distribution of *Elymus condensatus* and *E. triticoides* subsp. *multiflorus*, and the California range of *E. triticoides* and *E. cinereus*.

shorter than the spikelet; lemmas usually with a rather broad hyaline margin, short-awned or acute.

Santa Cruz County, California, south along the coast and on coastal islands to Lower California, inland to southwestern Kern County and the western tip of San Bernardino County.

This giant *Elymus* occurs on dry slopes and open woodlands and characteristically is a bunchgrass with culms in clumps of from ten to fifty. On both the eastern and western slopes of the coastal mountains north of Los Angeles, plants that presumably are seed-

lings form dense stands on recently burned slopes. Little is known concerning the range or morphological characteristics of the tetraploid and the octoploid segregates of *E. condensatus*. Differences in rhizome production, culm, leaf and spike dimensions, leaf pubescence, and fertility have been observed in the species and some of these may be found to be associated with chromosome number.

2. *ELYMUS CINEREUS* Scribn. & Merr. Bull. Torrey Bot. Club 29: 467. 1902. *E. condensatus* Presl. var. *pubens* Piper, Erythea 7: 101. 1899.

Caespitose perennial; culms usually 0.6–2 m. tall, pubescent or glabrous except for a fine, often microscopic pubescence on or in the vicinity of the nodes; leaf sheaths and blades pubescent or glabrous, frequently glaucous; spikes usually 10–20 cm. long, with 2 to 5 (rarely more) spikelets at a node, the central spikelets occasionally short-pedicelled; rachilla usually hairy, especially at the nodes; florets 3 to 6 in a spikelet; glumes subulate, about as long as the first lemma; lemmas pubescent or hairy at least on the upper portions, the apices bifid or obtuse, awnless or short-awned; palea usually with a dense tuft of hairs near the bifid apex.

Saskatchewan to British Columbia, south to New Mexico and California, in the latter state ranging chiefly east of the Sierra Nevada and not occurring in the Great Valley or immediately along the coast.

Elymus cinereus grows on dry slopes and plains in the desert mountain ranges of California from near sea-level to 7000 feet or higher. It is a plant of the Upper Sonoran zone and is frequent in *Artemisia tridentata* associations. The type collection from Pah-rump Valley, Nevada (*C. A. Purpus 6050*) is densely pubescent. The same form occurs in California, Oregon, and Washington and in the latter state has been recognized as *E. condensatus* var. *pubens* Piper. At least some of this extremely pubescent material is known to be octoploid but the extent to which this character is associated with the octoploid genotype has not been determined. A large extremely glabrous form of this species lacking even nodal pubescence in some specimens has been collected in Washington and Oregon. In the opinion of the writer this probably represents the hexaploid genotype although proof is lacking at present.

3. *ELYMUS TRITICOIDES* Buckl. Proc. Acad. Nat. Sci. Phila. 1862: 99. 1863. *E. Orcuttianus* Vasey, Bot. Gaz. 10: 258. 1885.

Culms single or in small clusters, glabrous or rarely with a fine pubescence on the upper internodes, glaucous especially at the nodes; rhizomes extensive, the internodes long and slender; leaves glabrous or sparsely hairy, rarely pubescent, glaucous or less frequently bright green; spikes 8–20 cm. long; spikelets sessile or rarely on short pedicels; glumes subulate or flat and

narrow, as long as or shorter than the first lemma; lemmas smooth or scabrous, short-awned from an acute or minutely bifid apex.

Montana and Washington south to Texas and Lower California and on the coastal islands of southern California.

Elymus triticoides, a plant of exposed slopes and valleys, is the only member of the genus to flourish as a weed of city lots and roadsides in the Western United States. The typical form, with slender culms, narrow leaves, and spikes that have only 1 or 2 spikelets at a node, is composed of both tetraploid and hexaploid populations. This form was at first thought to be entirely tetraploid and probably is predominately so when the entire range of the species is considered. Chromosome counts of several colonies of typical *E. triticoides* in the suburban district between Los Angeles and Long Beach indicate that here the hexaploid is more abundant. Population studies have disclosed a number of differences between the morphologically indistinguishable tetraploids and hexaploids in this region. The former flower two to three weeks earlier, have a pollen maturation of 75 to 98 per cent instead of 5 to 35 per cent, and have an average stomatal length and pollen grain size that is 15 to 20 per cent less than that of the hexaploids.

4. *ELYMUS TRITICOIDES* Buckl. subsp. *multiflorus* subsp. nov.

Culmi glabri 3.5–5 mm. diametro; laminae luminosae viridae, glabrae, 6–15 mm. latae; spicae magnae, irregulares, aliqui nodi cum 3 ad 6 spiculae, aut spiculae 17–25 mm. longae; spiculae saepe in brevibus ramis, cum 6 ad 9 florum.

Culms stout, frequently in dense clumps; rhizomes thicker and less extensive than in the species; blade usually bright green, glabrous, broad; spikes large, irregular, the spikelets, when crowded, frequently on short pedicels; florets highly sterile; glumes longer than in the species, usually exceeding the first lemma.

Type. Near San Francisco Bay at Albany, Contra Costa County, California, July 4, 1941, *Frank W. Gould 1304* (University of California Herbarium no. 686616).

This large hexaploid occurs in dense stands along the coastal region of central and, to a lesser extent, southern California. Although belonging to the *E. triticoides* complex it has numerous characters in common with the giant *E. condensatus* which occupies a similar range. Dr. G. L. Stebbins, Jr., of the University of California, who has done much of the preliminary cytological work on this group, believes the large hexaploid in general possesses two genomes of *E. triticoides* with one of *E. condensatus*. A logical assumption is that *E. triticoides* subsp. *multiflorus* is comprised of allopolyploids and that hexaploids of the typical form of the species are autopolyploids. Whatever their genetical constitution, it is quite apparent that these hexaploids have had a polyphyletic origin.

It is the intent of the writer to ascribe to subsp. *multiflorus* only those plants which are morphologically characteristic. It is expected, however, that all specimens referable to this group will have a somatic chromosome number of 42.

The following records of chromosome counts have been utilized in this study. These are taken from Stebbins and Love's paper (2) and from previously unpublished data of Dr. Stebbins and the writer. The writer is greatly indebted to Dr. Stebbins for his cooperation and helpful criticism during the course of this study.

Elymus condensatus Presl.

($2n = 28$) CALIFORNIA. Ventura County: *Stebbins 2864*. Los Angeles County: *Stebbins 2859*.

($2n = 56$) CALIFORNIA. Ventura County: *Gould 2357*. Los Angeles County: *Gould 2344*.

Elymus cinereus Scribn. & Merr.

($2n = 28$) OREGON. Grant County: *Soil Conservation Service no. W 5754-40P*. Baker County: *Soil Conservation Service no. W 5754* (counts by Stebbins).

($2n = 56$) WASHINGTON. Whitman County: *Soil Conservation Service no. W 3335* (seed). UTAH. Iron County: Cedar Breaks National Monument, *W. S. Boyle* (counts by Stebbins).

Elymus triticoides Buckl.

($2n = 28$) CALIFORNIA. Plumas County: *Stebbins 2923*. Marin County: *Gould 1299*. Contra Costa County: *Gould 1271, 1284, 1286*. Alameda County: *Stebbins 2702, 2753; Gould 1283*. San Mateo County: *Gould 1292*. San Benito County: *Stebbins 2754, 2755*. Merced County: *Stebbins 2800*. Los Angeles County: *Gould 2173, 2331, 2332, 2340, 2343*.

($2n = 42$) CALIFORNIA. Merced County: *Stebbins 2797*. Los Angeles County: *Gould 2335, 2339, 2341, 2346*.

Elymus triticoides Buckl. subsp. *multiflorus* Gould.

($2n = 42$) CALIFORNIA. Contra Costa County: *Gould 1279, 1288, 1291*. Kern County: *Stebbins 3010*. Los Angeles County: *Stebbins 2858; Gould 2333, 2334*.

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